MISSOURI'S LAKE STURGEON REINTRODUCTION PLAN

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Purpose: Lake sturgeon were once abundant in the major rivers in Missouri but are now endangered. It is doubtful whether lake sturgeon will increase in abundance naturally. The fact that only occasional adults are caught suggests that natural reproduction is either non-existent in Missouri or survival of young is not sufficient to increase population numbers.

It is believed that suitable habitat exists in major rivers and lakes in Missouri and that lake sturgeon can thrive and once again be a viable part of the fauna of the state. Our objective is to determine whether lake sturgeon can be reestablished by stocking hatchery produced fingerlings.

The purpose of this report is to summarize available information on the life history of lake sturgeon, discuss the potential for establishing lake sturgeon populations and fisheries, and provide information so that fishery administrators and managers can make informed decisions regarding the best areas to stock them to reestablish viable lake sturgeon populations.

Geographic Range: Few North American freshwater fish have a wider geographic range than the lake sturgeon. It is found in three drainage basins: the Mississippi River, the Great Lakes, and Hudson Bay (Priegel and Wirth 1977; Harkness and Dymond 1961). This large, primitive, freshwater fish is found in greatest abundance in large lakes and rivers of the Great Lakes region of the United States and Canada. Almost all of its range in the United States is in the Mississippi River Basin from the upper Mississippi River and major tributaries to the southern border of Arkansas.

In Missouri, lake sturgeon were common in the Missouri and Mississippi rivers before 1900 but their numbers have declined markedly. Now, only an occasional lake sturgeon is reported and the species is classified as rare and endangered (Nordstrom, et al. 1977). Pflieger (1975) reported that before Lake of the Ozarks was built on the Osage River (1931), lake sturgeon were often caught in the lower portions of that stream.

Population Decline: Lake sturgeon were an important commercial fish in the Great Lakes region during the late 1800's. Most of the fish were processed as smoked sturgeon, as well as for caviar, isinglass, and fish oil. Because of the large market for sturgeon flesh, they were recklessly and wastefully exploited (Priegel and Wirth 1977). They report that the major factors that contributed to the decline in lake sturgeon populations were overexploitation, pollution, construction of dams, destruction of spawning areas, and deliberate destruction of fish to protect commercial fishing gear. Because of man's mismanagement of the fish and its native environment, lake sturgeon populations declined rapidly. For example, the Lake Erie sturgeon catch declined from over 5,000,000 pounds to less than 1,000,000 pounds between 1885 and 1895, a decline of over 80% (Harkness and Dymond 1961). In Lake of the Woods, harvest declined 90% in 7 years (1893-1900). Pflieger (1975) reports that in Missouri, 50,000 pounds of lake sturgeon were harvested commercially from the Missouri and Mississippi rivers in 1894 and the catch of lake sturgeon prior to 1900 often exceeded the catch of shovelnose sturgeon. Throughout most of its range, lake sturgeon populations have declined drastically.

Habitat and Habits: The lake sturgeon is a shallow-water, bottom-dwelling fish. It occurs only in lakes and rivers with extensive shallow water where benthic invertebrates, their primary food, are abundant. Harkness and Dymond (1961) report that most lake sturgeon were captured in lakes at depths less

than 30 feet, and a high proportion were in water less than 15 feet. They will feed over any type of bottom substrate that supports the kinds of animals they can use as food.

Priegel and Wirth (1977) report that the foods of lake sturgeon differed according to availability. Its diet may contain leeches, snails, small clams, insect larvae, and other miscellaneous invertebrates. Small fish and small pieces of fresh fish are eaten, evidenced by hook and line catches, but these are probably not as important as natural food items.

Within their home range, whether in a lake or river, lake sturgeon travel widely, often in loose aggregations (Priegel and Wirth 1977). They leave these basins only to spawn and then return. In Wisconsin, tagging studies have demonstrated that lake sturgeon in Lake Winnebago have a strong homing tendency. These fish migrate through Big Lake Butte des Morts, Lake Winneconne and Lake Poygan to spawning sites as far as 125 miles upstream in the Wolf River. Lake sturgeon from Lake Winnebago and the upriver lakes will spawn together, often returning to the same spawning sites, but return to the respective lake from which they originated (Personal Communications, May 1984, Dan Folz, Wisconsin Department of Natural Resources, Oshkosh, Wisconsin).

Young lake sturgeon, after their first year, are found in the same habitat as adults. Sampling using gill nets and electrofishing gear indicates that small lake sturgeon may spend their first year of life in the river where they were hatched, then move downstream into the lakes the next year. Because of difficulties in sampling small sturgeon, little is known about their early life history.

Natural Reproduction: Lake sturgeon are late maturing fish, similar to paddlefish. In Wisconsin, females do not become sexually mature until they are 24 to 26 years of age and weigh about 45 pounds (Personal Communications,

May 1984, Dan Folz, Wisconsin Department of Natural Resources, Oshkosh, Wisconsin). Like paddlefish, female lake sturgeon do not spawn every year. Instead they spawn at intervals of four, five, or six years (Priegel and Wirth 1977). Few males mature until they are 14 to 16 years old and weigh about 25 to 30 pounds. It is believed that males are capable of spawning every year.

In Wisconsin, lake sturgeon generally spawn in rivers. Occasionally they will spawn on rocky, windswept points in lakes; however, they prefer the outside bends of riverbanks, especially where the current is strong and upboiling. They prefer to spawn on rocks, boulders, and broken slabs of concrete placed in the river for riprap. Personnel from Wisconsin report that most of the present spawning sites in the Wolf River are the results of rip-rapping raw bank sites (Personal Communications, May 1984, Dan Folz, Wisconsin Department of Natural Resources, Oshkosh, Wisconsin). They also believe that new spawning sites can be created in streams with limited spawning habitat by adding slab concrete or large boulders.

Lake sturgeon spawn in late April and early May in rivers when the flow is high and water temperatures rise slowly. Increased flows stimulate upstream movement. Sturgeon may arrive in the vicinity of the spawning site as much as a week before spawning takes place and wait there until the water temperature reaches the optimum. Males usually precede females to the spawning site. In years of high flows and slow temperature rises, lake sturgeon can spawn at 53°F, whereas in years of low water when the water temperature rises quickly, they will spawn when the temperature reaches 58° to 59°F. Spawning sturgeon are very sensitive to changes in water temperature. A drop of only a few degrees in water temperature is enough to cause a temporary halt in spawning activities.

Lake sturgeon spawn in water ranging from 1 to 15 feet but most spawn at 2 to 3 feet. They often spawn within a few feet of the bank in water shallow enough that their snouts, tails and dorsal fins are exposed. Several males accompany each female during spawning. The gray-black eggs are adhesive and attach to the first substrate they touch. The eggs hatch in about 5 days when water temperatures are 60°F.

Lake sturgeon are vulnerable when spawning because they are close to bank in shallow water. In Wisconsin, poaching of adult sturgeon on the spawning sites necessitates guarding these fish until spawning is completed (Personal Communications, May 1984, Dan Folz, Wisconsin Department of Natural Resources, Oshkosh, Wisconsin).

Growth and Longevity: Lake sturgeon grow relatively slow and are long lived. In Lake Winnebago, lake sturgeon are about 11 inches after their first year of life, 23 inches (3 pounds) after 3 years, 33 inches (12 pounds) after 6 years, 42 inches (20 pounds) in 8 years and 50 inches (35 pounds) in 15 years (Priegel and Wirth 1977). Priegel (1973) reports that there is a wide variation in growth for all age groups, especially the older ones. Growth of lake sturgeon in the Menomonie River in Wisconsin is considerably slower than in Lake Winnebago. Priegel and Wirth (1977) report that the variation in growth rates within the same river system or between sturgeon in different waters depends on several factors, including water temperature and amount of available food. In the Menomonie River, sturgeon reach the minimum legal size of 42 inches at age 15, while in Lake Winnebago, this size sturgeon would average 8 years old. The oldest recorded lake sturgeon was from Lake of the Woods, Ontario, and weighed 215 pounds and was 152 years old (Priegel and Wirth 1977).

Potential for Missouri: Lake sturgeon were relatively common in the Missouri and Mississippi rivers in Missouri prior to 1900. Overharvest, pollution, and the construction of dams probably contributed to their decline. Lake sturgeon are now rare in Missouri with only isolated reports of single individuals being caught in the Missouri and Mississippi rivers during the last 10 to 15 years. These are probably strays from the upper Mississippi River Basin. The fact that the only lake sturgeon reported are occasional adults suggests that natural reproduction is either non-existent, or survival of young is insufficient to increase population numbers. Therefore, stocking hatchery-produced fish would be the quickest way to increase the numbers of lake sturgeon in Missouri. The ultimate goal would be for the stocked fish to spawn and replenish themselves naturally, given adequate protection from overharvest.

Based upon our successes of stocking 8- to 10-inch hatchery produced paddlefish, I believe that similar successes can be achieved by stocking similar sized lake sturgeon. They should be a large enough size to escape predation from most other fishes and have a reasonable chance for survival. Growth is highly variable within their native range, but I believe that growth in Missouri would be faster than that reported in northern states because of warmer water. If growth rates are faster in Missouri, the fish should mature sooner than in Wisconsin and may be sexually mature at about the same age as paddlefish. If they grow at the same rate as paddlefish, they could weigh 30 pounds within 10 years; assuming adequate natural food is available.

Areas for Potential Release: The success of stocking hatchery produced lake sturgeon in Missouri will depend upon whether we can eventually develop populations. The selection of these stocking areas should be made with special consideration for the habitat requirements of the fish and should

include rivers and lakes where natural populations might develop. They should be stocked into habitats where they have the best opportunity to find natural foods and where they potentially can spawn. Lake sturgeon are probably best suited for large rivers or in large reservoirs where they can migrate up tributary streams to spawn. These potential tributary streams should be subject to moderate to high spring flows and have sufficient natural or artificially placed spawning habitat. Although spawning requirements are similar to those of paddlefish but not as exacting, I believe lake sturgeon populations might be successfully established in areas designated as potential paddlefish spawning areas. However because lake sturgeon would likely be vulnerable to snagging or grabbing during the spawning season, these areas should be carefully selected because lake sturgeon might be snagged accidentally while fishing for paddlefish.

Stocking Schemes: Our objective is to determine whether lake sturgeon populations can be established by stocking hatchery produced fingerlings. To help with this decision, some sturgeon should be stocked into relatively small bodies of water where we can sample them within 2 to 3 years. Small impoundments (2 to 10 acres) should be of sufficient size to provide adequate natural food and still be sampled effectively. Information from these stockings would be important in predicting success of introductions into large bodies of water and determining stocking densities.

Our goal is to reintroduce lake sturgeon into previously occupied habitat (the Missouri, Mississippi, and Osage rivers), or into other suitable areas where it is likely that a population can be developed. It is presumed that if conditions in these major rivers are conducive to survival and growth of hatchery stocked lake sturgeon, then viable populations can be developed.

Large River Stockings: Although the Missouri and Mississippi rivers once provided excellent lake sturgeon populations, most of their native habitat has been seriously altered or lost. The Missouri River is probably not as well suited for lake sturgeon as the Mississippi River because it has a steeper gradient, has fewer sloughs and backwater areas for feeding and has a bottom substrate that is constantly shifting. Because of the larger amount of littoral areas in the Mississippi River, benthic production is probably higher.

Rock dikes on both of these rivers appear to be similar to the riprap spawning substrate on the Wolf River, Wisconsin. There is a good possibility that lake sturgeon could spawn on the outer ends of these dikes in the upboiling current. I believe that fingerling lake sturgeon could be stocked in the quiet, productive water behind the dikes where invertebrate populations are highest. The pooled portion of the Mississippi River should be excellent habitat for growth because of its diverse benthic community. Additionally, sloughs that flood periodically could be used as release sites. Hopefully, newly stocked fingerlings would remain in these areas (behind dikes and in sloughs) long enough to grow, increasing their chances for survival.

I believe habitat in the lower Osage River below Bagnell Dam is excellent for establishing lake sturgeon populations. The river is low gradient and has good invertebrate populations necessary for feeding. The boulder and gravel substrate should provide excellent spawning habitat. Sturgeon stocked in this area will have direct access to the Missouri River. Fingerling lake sturgeon should be stocked in quiet water where natural food is most abundant. Based on the fishes spawning requirements in Wisconsin, I believe the lower Osage River meets those requirements better than the Missouri and Mississippi rivers.

I believe that once lake sturgeon populations are established in the major rivers of our state, fisheries could be developed if they are carefully regulated to protect the population. Based on information from northern states, lake sturgeon can be caught on pole and line in deep pools and below low dams or other obstructions that concentrate fish.

Large Reservoir - Stream Stockings: Lake sturgeon appear ideally suited for stocking in several of our larger reservoirs, especially those with tributary streams having sufficiently high spring flows and spawning substrate necessary for reproduction. Because most reservoirs have more littoral area and have higher invertebrate populations than most riverine habitats, I expect lake sturgeon will grow faster in reservoirs than in rivers. Lake sturgeon should be stocked in the portion of the reservoir having the best benthic populations.

Because of potential compatability problems by stocking lake sturgeon into waters where we already have established paddlefish populations, I believe we must be cautious. I believe that lake sturgeon populations could be developed in Lake of the Ozarks. The reservoir has an adequate invertebrate population and the boulder/rock riprap in the discharge channel and along the levees below Truman Dam appears to be suitable spawning habitat. The strong river current on the outside bends of these rocked areas are similar to the known spawning areas in the Wolf River, Wisconsin.

Another reservoir that contains paddlefish and may be well suited for lake sturgeon is Harry S. Truman Reservoir. The extensive shallow water areas should provide adequate food and the major tributary streams offer potential spawning substrate. The Pomme de Terre and Sac rivers have excellent gravel areas; however, flows from upstream reservoirs might not be sufficient to trigger upstream migration during the spring spawning run. The Marais des

Cygnes River (the major tributary) has considerable rubble and boulder substrate and might offer the best opportunity for spawning. Spring flows are frequently high which would provide the necessary stimulus for lake sturgeon to migrate upstream.

Lake Wappapello has the most littoral area of any of our larger reservoirs and the St. Francis River above the lake appears to have adequate rock and gravel substrate for spawning. Based on the original range of lake sturgeon, Lake Wappapello might be on the southern extremity of their preferred range.

In early fall 1984, about 11,000 lake sturgeon fingerlings were stocked into Mark Twain Lake. We chose this reservoir because it was new, had recently filled, had a relatively small predator population, and it was fairly turbid. Because of its recent filling, Mark Twain Lake should have excellent natural foods. Its major tributary, Salt River, has gravel substrate, is subjected to high spring flows and might be selected as a spawning area.

I expect that hook and line fisheries will develop in lakes. Like channel catfish, lake sturgeon can probably be caught in lakes in areas where natural food is most abundant or in deep water during the summer.

There are several other medium- to large-sized reservoirs in Missouri where lake sturgeon could be stocked. Several are located in southern Missouri and may be on the southern extremity of the sturgeon's preferred range. The Ozark reservoirs generally have tributary streams with adequate gravel but are typically steep-sided and do not have expanses of littoral area for invertebrate production. Any reservoir selected for stocking should have the necessary requirements for survival, growth, and future reproduction.

Conclusions: I believe that it will be possible to reestablish lake sturgeon into previously occupied habitat in Missouri if we can produce adequate

numbers of advanced fingerlings (8-inch minimum size) in our hatcheries. We are presently learning how to rear fingerlings and what kind of food they prefer.

By reintroducing lake sturgeon into Missouri waters, we hope to increase population numbers to a level that will reproduce naturally and provide a sustained hook and line fishery. Even if natural reproduction does not occur, we would like to provide anglers the opportunity to catch this unique, trophy-sized fish.

Information from this report should be used to assist in choosing potential stocking sites and for determining the objectives of those stockings. These decisions should be made jointly by our administrators and fishery managers.

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